

5/5/17 "Wherever smart people work, doors are unlocked."-Steve Wozniak

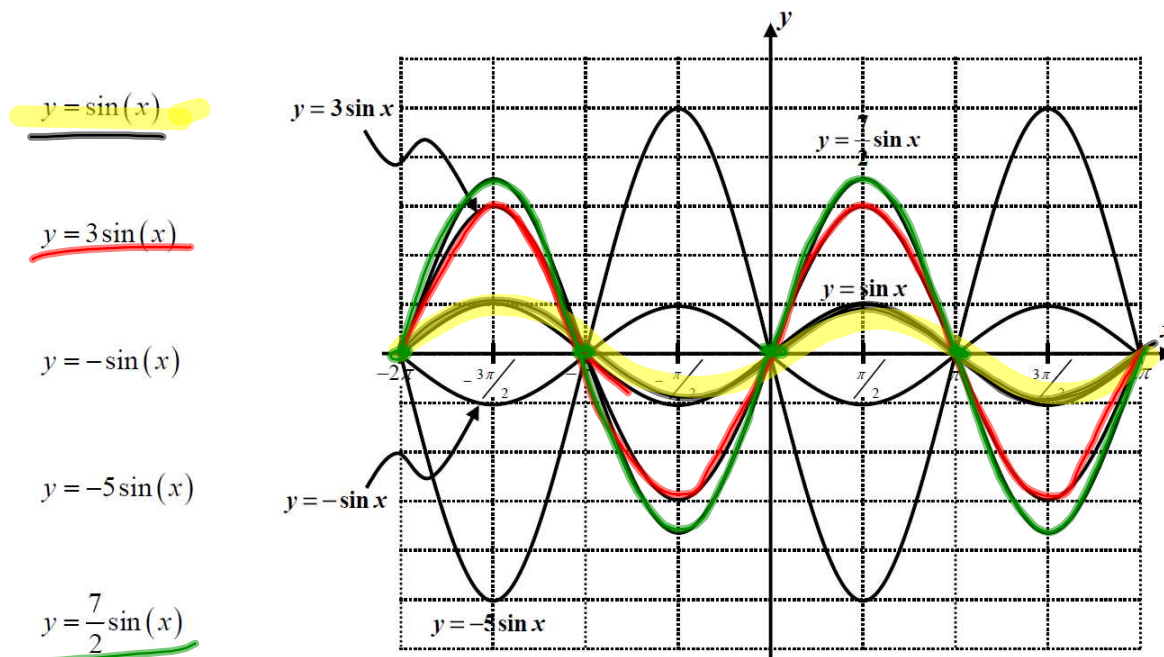
HW: "Frequency and Period of Sinusoidal Graphs" Homework section
Test 2 on Thursday 5/18

AIM: What are the Frequency and Period of Sinusoidal graphs?

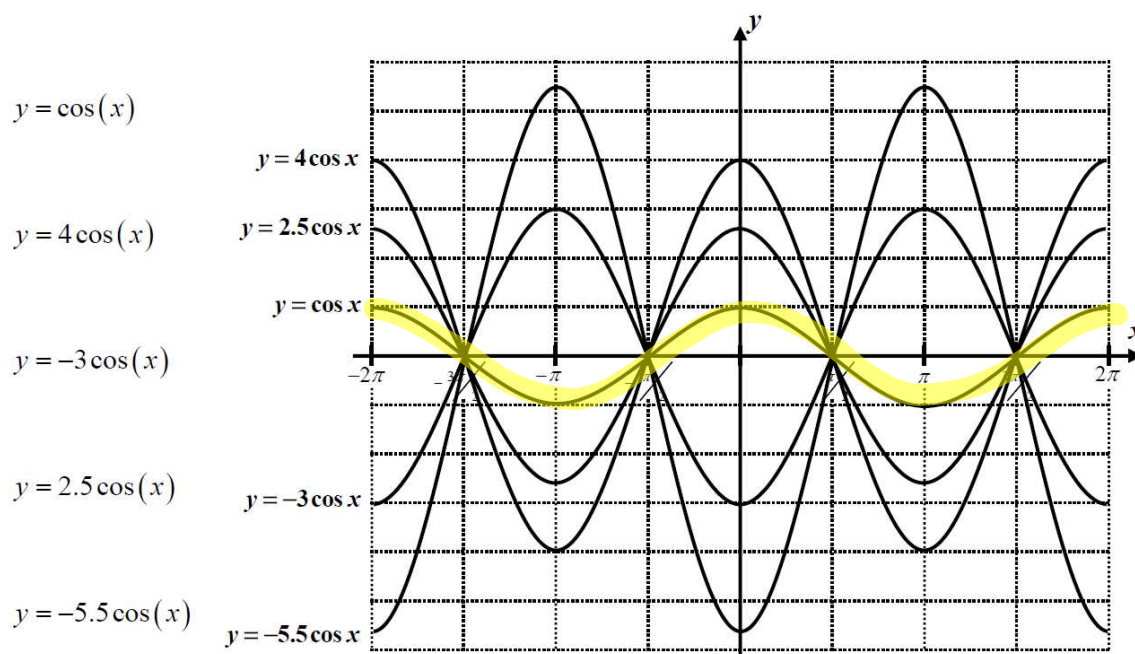
Warm Up:

Homework Check:

1. On the grid below, sketch the graphs of each of the following equations based on the basic sine function.



2. On the grid below, sketch the graphs of each of the following equations based on the basic cosine function.



3. Which of the following represents the *range* of the trigonometric function $y = 7 \sin(x)$?

- (1) $(-7, 7)$ (3) $[0, 7]$
 (2) $[-7, 7]$ (4) $(-7, 7]$

Since the amplitude is now 7, the sine graph must rise and fall 7 units above the x -axis.

(2)

4. Which of the following is the period of $y = \cos(x)$?

- (1) π (3) 2π
 (2) 2 (4) $\frac{3\pi}{2}$

The basic cosine and sine graphs will repeat themselves every 2π units along the x -axis.

(3)

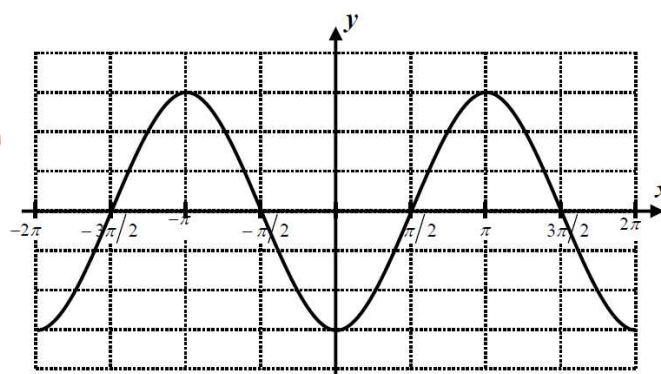
5. Which of the following equations describes the graph shown below?

(1) $y = 3 \cos(x)$

(2) $y = -3 \cos(x)$

~~(3) $y = 3 \sin(x)$~~

~~(4) $y = -3 \sin(x)$~~



This graph is clearly based on cosine, but because it "starts" at a minimum, it must be multiplied by a negative.

(2)

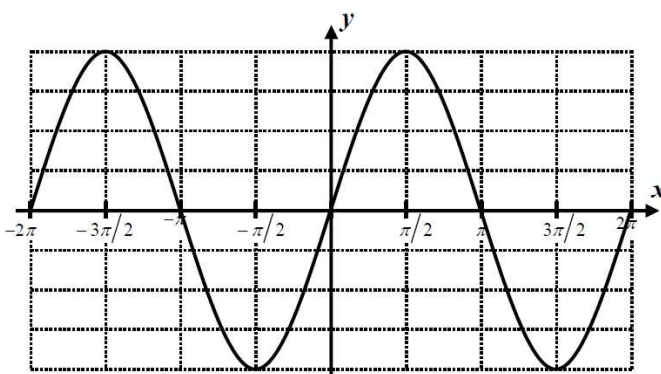
6. Which of the following equations represents the periodic curve shown below?

~~(1) $y = 4 \cos(x)$~~

~~(2) $y = -4 \cos(x)$~~

(3) $y = 4 \sin(x)$

(4) $y = -4 \sin(x)$



This is the basic sine graph that has been stretched by a factor of 4 in the vertical direction. Since it "starts" by increasing out of the origin, it is multiplied by a positive.

(3)

7. Which of the following lines when drawn would not intersect the graph of $y = 6 \sin(x)$?

~~(1) $x = 8$~~

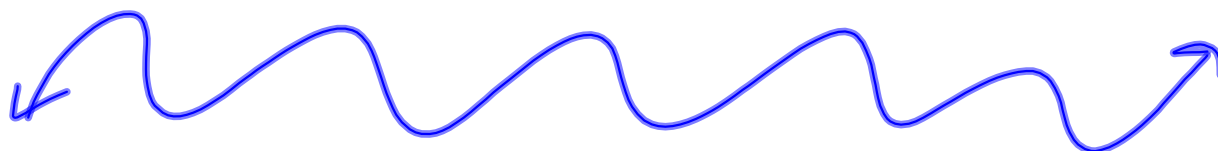
~~(3) $y = -4$~~

~~(2) $x = 3$~~

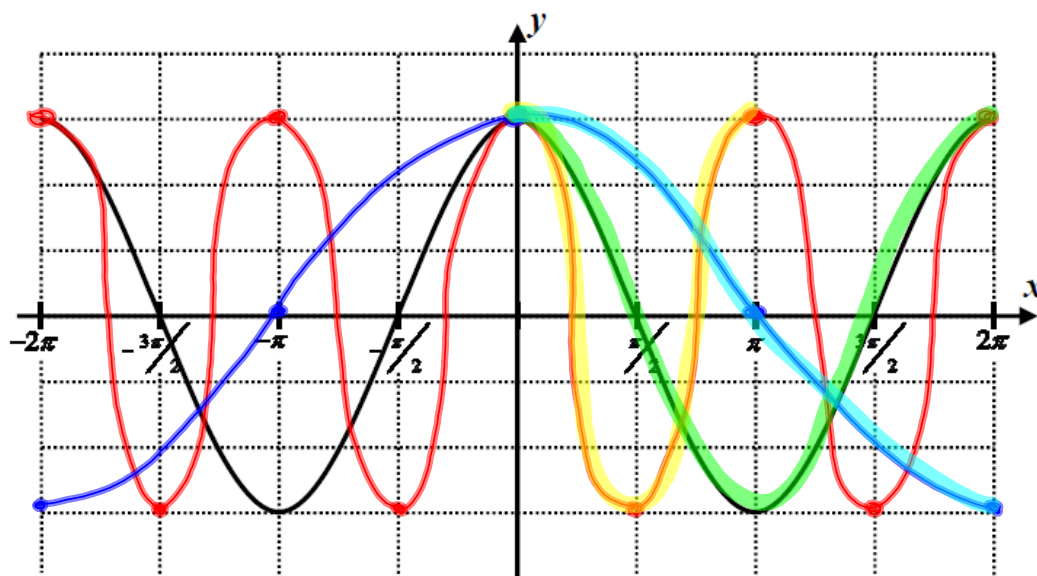
(4) $y = 9$

The range of this sine function is $[-6, 6]$; thus, the graph will never hit the horizontal line $y = 9$.

(4)



Exercise #1: On the grid below is a graph of the function $y = 3 \cos(x)$.



- (a) Using your calculator, sketch the graph of $y = 3 \cos(2x)$ on the same axes.

- (b) How many full cycles or periods of this function now fit within 2π radians?

2 full cycles

- (c) Using your calculator, sketch the graph of $y = 3 \cos\left(\frac{1}{2}x\right)$ on the same axes.

- (d) How many full cycles or periods of this function now fit within 2π radians?

$\frac{1}{2}$ full cycle

The **period**, P , of a sinusoidal function is an extremely important concept. It is defined as **the minimum horizontal shift needed for the function to repeat its fundamental pattern**. The period for the basic sinusoidal graphs is 2π . Clearly, from our first exercise, the period of the function depends on the coefficient B in the general equations $y = A \sin(Bx)$ and $y = A \cos(Bx)$. This coefficient, B , is known as the **frequency**.

Period: How long for 1 full curve

Exercise #2: Consider the graphs from **Exercise #1**. For each below, state the frequency and period.

(a) $y = 3 \cos(x)$

Frequency, $B = 1$
Period, $P = 2\pi$

(b) $y = 3 \cos(2x)$

Frequency, $B = 2$
Period, $P = \pi$

(c) $y = 3 \cos\left(\frac{1}{2}x\right)$

Frequency, $B = \frac{1}{2}$
Period, $P = 4\pi$

Clearly we can see from **Exercise #2** that the frequency and period are **inversely related**, that is as one increases the other decreases and vice versa.

Exercise #3: Examine the results from **Exercise #2**. What is true about the product of the period, P , and the frequency, B ? Write an equation for this relationship.

$$P \cdot B = 2\pi$$

$$\text{Period} = \frac{2\pi}{\text{Freq.}}$$

$$\text{Frequency} = \frac{2\pi}{\text{Period}}$$

Exercise #4: Determine the period of each of the following sinusoidal functions. Express your answers in exact form.

(a) $y = 6 \sin(4x)$

freq = 4
Period = $\frac{2\pi}{4} = \frac{\pi}{2}$

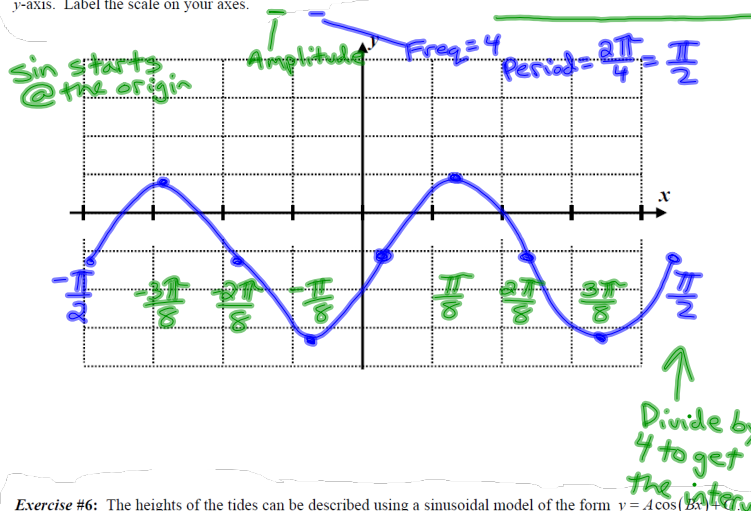
(b) $y = 8 \cos\left(\frac{\pi}{3}x\right)$

freq = $\frac{\pi}{3}$
Period = $\frac{2\pi}{\frac{\pi}{3}} = 6$

(c) $y = -12 \sin\left(\frac{2}{3}x\right)$

freq = $\frac{2}{3}$
Period = $\frac{2\pi}{\frac{2}{3}} = 3\pi$

Exercise #5: Sketch the function $y = 2 \sin(4x)$ on the grid below for one full period to the left and right of the y-axis. Label the scale on your axes.



Exercise #6: The heights of the tides can be described using a sinusoidal model of the form $y = A \cos(Bx)$. If high tides are separated by 24 hours, which of the following gives the frequency, B , of the curve?

(1) 12

(3) $\frac{\pi}{12}$

(2) $\frac{\pi}{24}$

(4) $\frac{\pi}{6}$

Period

$$\text{Frequency} = \frac{2\pi}{\text{Period}}$$

$$\text{Freq} = \frac{2\pi}{24} = \frac{\pi}{12}$$

